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Evaluation of a new muon monitor sensor for the T2K experiment using the J-PARC neutrino beam

The Tokai to Kamioka (T2K) experiment is a long baseline neutrino experiment in Japan. We measure neutrino oscillations in the T2K experiment by using an almost pure muon neutrino beam produced at J-PARC accelerator facility. In December 2023, J-PARC achieved operation at 760 kW, exceeding its original design power. The T2K experiment plans to further increase the proton beam power to 1.3 MW to increase the statistics.

The T2K has the muon monitor (MUMON) that indirectly monitors the neutrino direction and intensity. MUMON measures muons produced along with neutrinos in the decay of pions in real time. Although MUMON has successfully measured at the current beam intensity, we expect certain issues with MUMON senser in future operation with higher intensity beams such as radiation damage. Sensors that are more radiation tolerant are desired for future operation of MUMON. An electron multiplier tube (EMT) is one candidate. Previous beam tests and investigations using the prototypes installed at J- PARC have shown that the EMTs fulfill the requirements for MUMON at future beam intensity. Based on these results, seven EMTs were installed inside MUMON in January 2023. The results of muon beam measurements in T2K neutrino beam operation using these EMTs will be presented.

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